

Challenges and practices of AIOPS for carrier IP network

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IETF-125, March 2026

About China Mobile

Workforce: 450,000 employees

Annual Revenue: around 145 billion USD (2024)

Customers:

- 1005 million mobile subscribers
- 323 million wired broadband users

Network & AI Infrastructure:

- Deployed over 2.65 million 5G base stations — the world's largest 5G network
- Operates more than 1 million servers, total AI computing power: 61.3 EFLOPS (FP16)

Drivers for AIOps

Business Requirements

- Quality UP. Customers expect "zero-wait, zero-failure, zero-touch" superior network experiences.
- Cost DOWN. Operators face intense pressure on OPEX while maintaining high service quality.

Infrastructure Complexity

- Exponential growth in network scale, such as AI training clusters, tens of thousands of devices.
- Convergence of network and cloud adds layers of complexity which cannot be handled efficiently.

AI Advancements

- The maturity of LLMs makes it possible for understanding unstructured data.
- Emergence of autonomous agents are capable of complex collaboration.

Challenges in AIOps

1. The Data Quality & Volume

- Fragmented: Data is trapped in silos that do not talk to each other.
- Inconsistent: Missing timestamp, inconsistent formatting, etc.
- Overwhelming: petabytes of data lead to high cost of processing.

2. Lack of efficient communication means

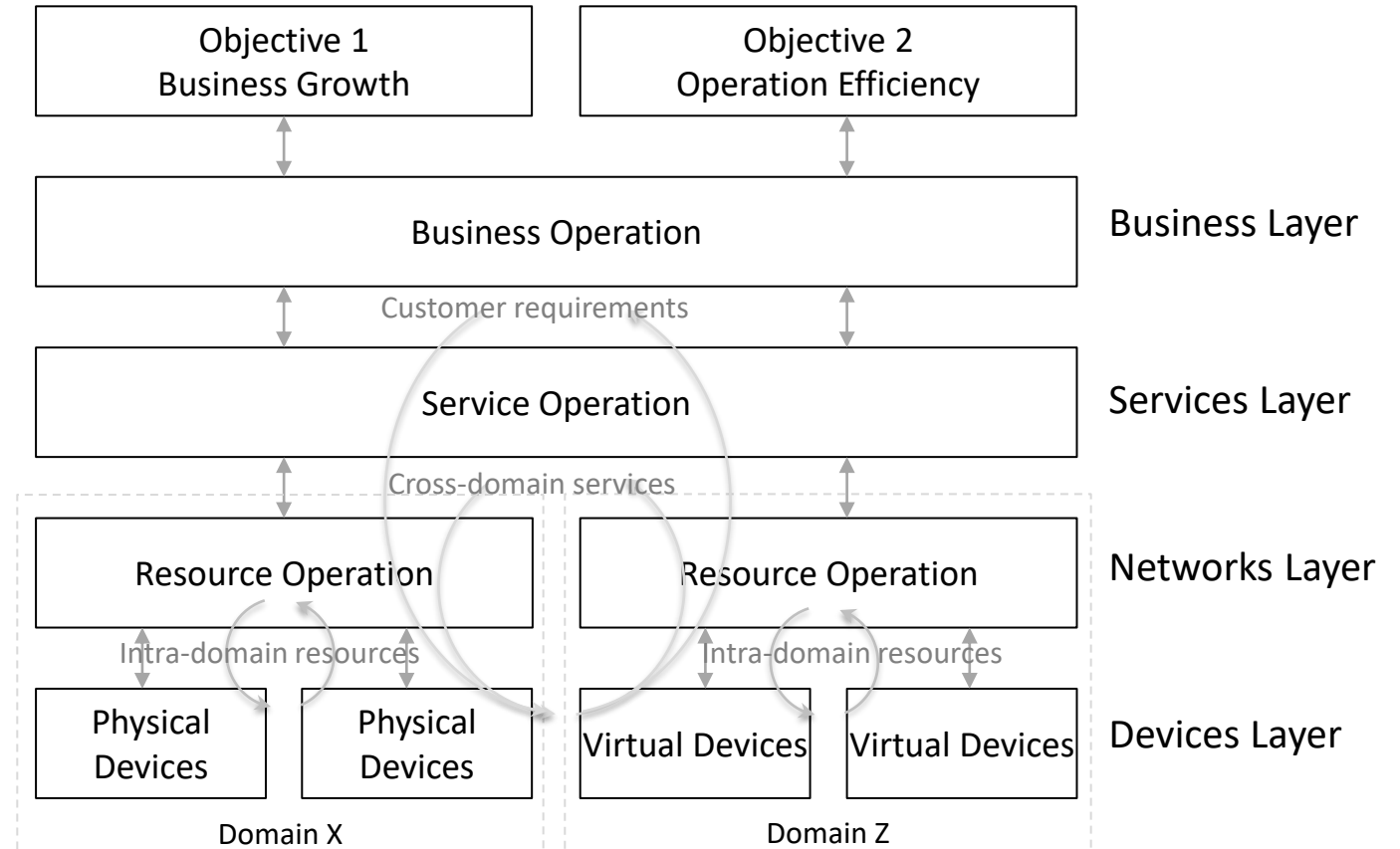
- Multi-Vendor: hard to standardize data across different hardware vendors.
- Efficiency: communicate data rather than information. Consider an unexpected traffic surge case.

3. The “Black Box” & AI Hallucination

- Lack of Explainability: Provide a result without explaining why.
- Fear of auto-disruption: lead to "Read-Only" AIOps, which only give suggestions

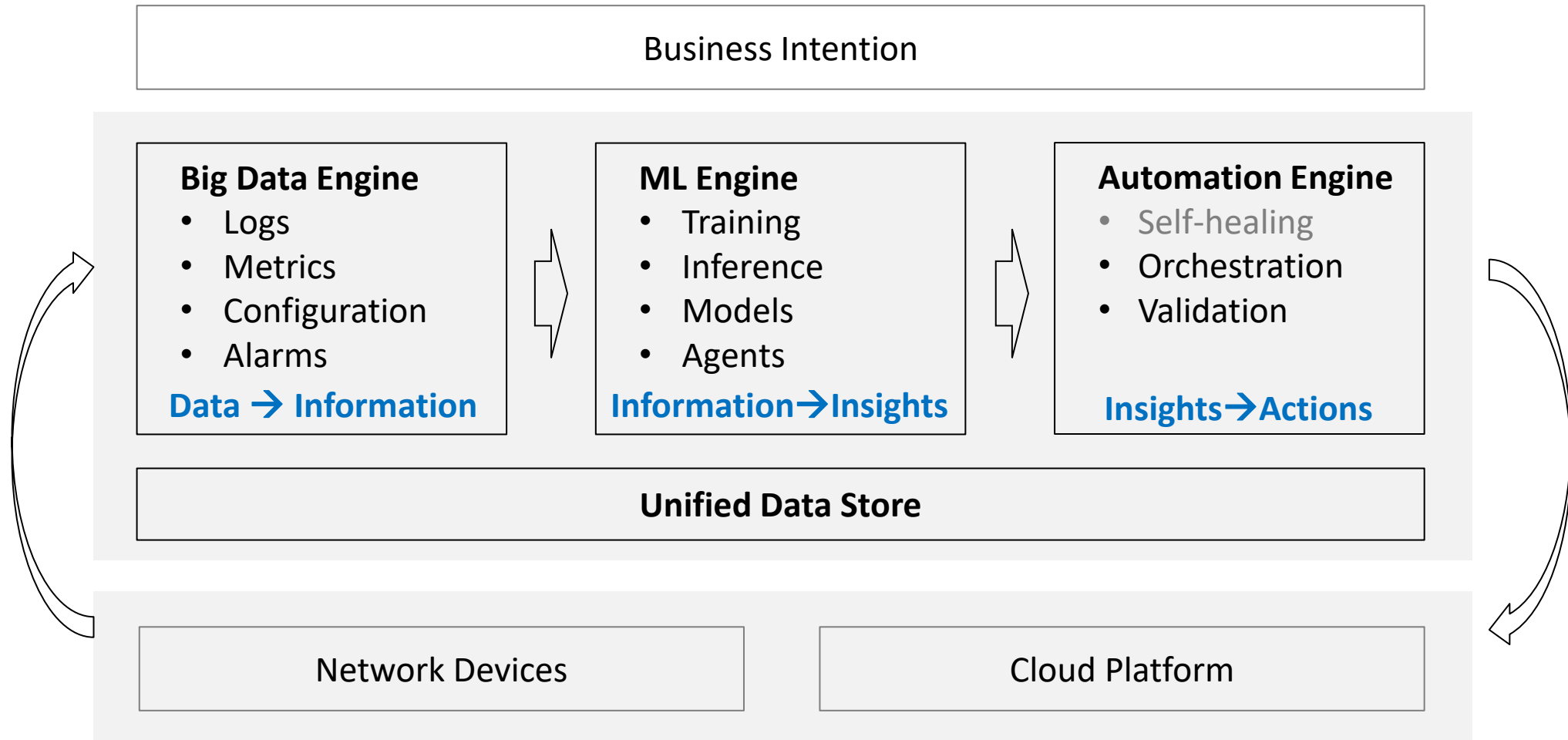
Overview of China Mobile AIOps

- 2 core business objectives:
 - supporting customer growth
 - reinforcing quality leadership
- 3 closed-loop management:
 - customer requirements
 - cross-domain services
 - intra-domain resources
- 4 layers of intelligent operations
 - Devices
 - Networks
 - Services
 - Business



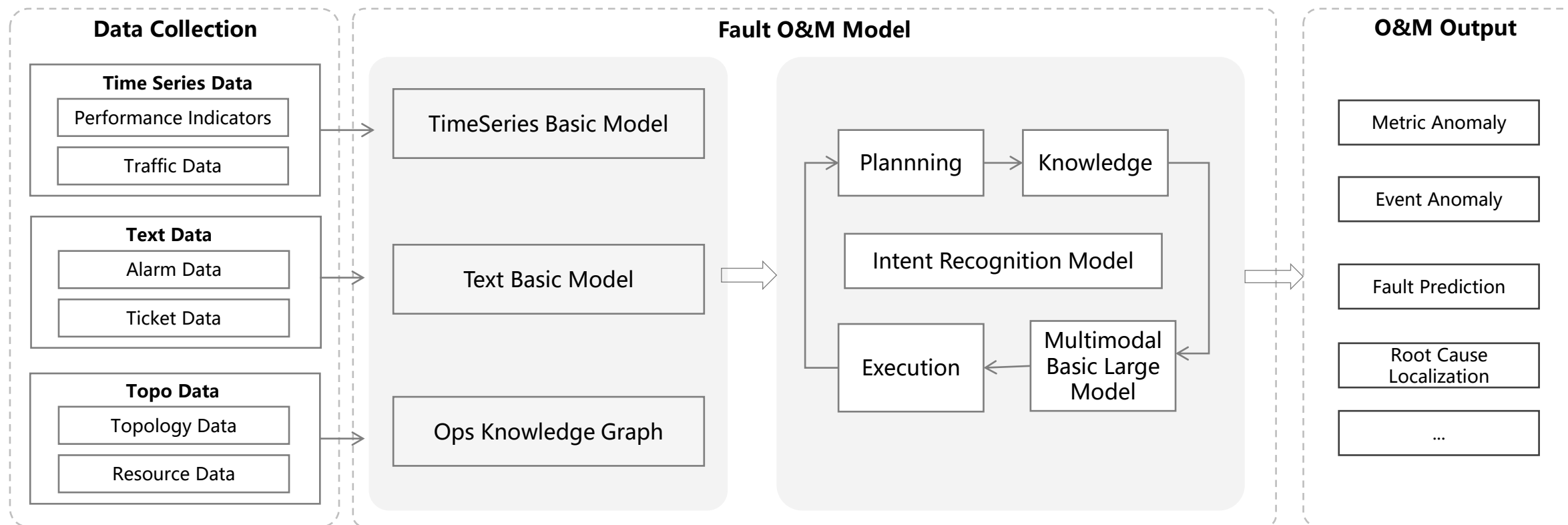
Architecture of AIOps China Mobile Follows

Basically, it is a process of turning data from information to action.



Example 1: Fault O&M of IP Network

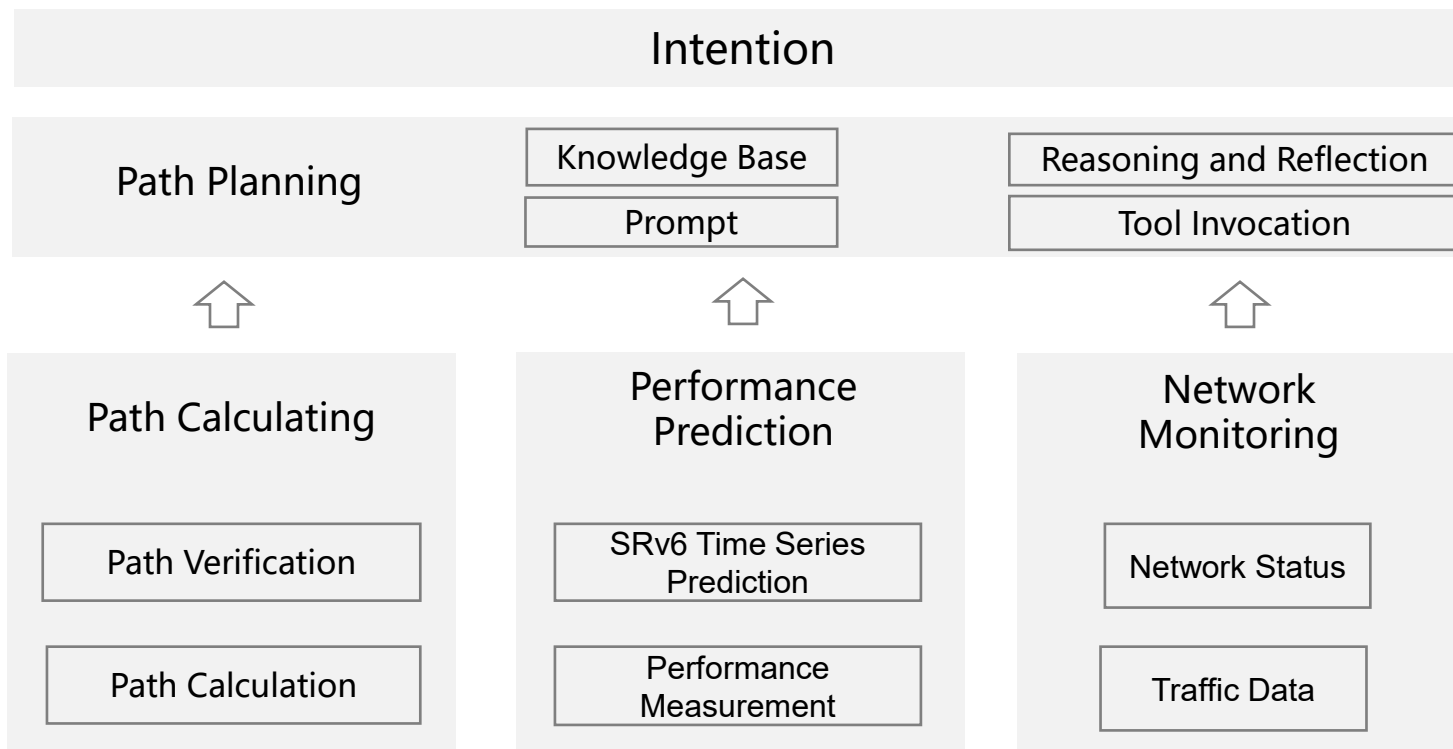
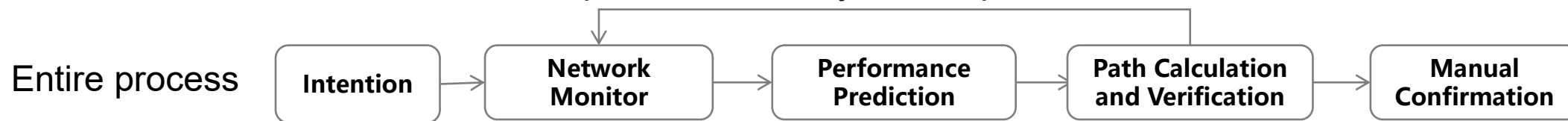
- Since general-purpose LLM lacks domain-specific understanding, we build **dedicated private models**, and train specialized skills on **massive, highly correlated** operational data.
- To **mitigate hallucinations** and ensure safe, reliable operation, we have strict rules on automation scope and human-in-the-loop verification mechanisms.



More than 60% faults are handled by AIOps system, most of them are processed within several minutes

Example 2: SRv6 Path Planning of

- SRv6 path computation requires massive, high-dimensional real-time data—such as latency, packet loss rate, link status, and topological paths.
- To address this, **data distillation** is an important process to feed optimal path information for path calculation and enable short-term prediction and dynamic optimization.



Key Capabilities

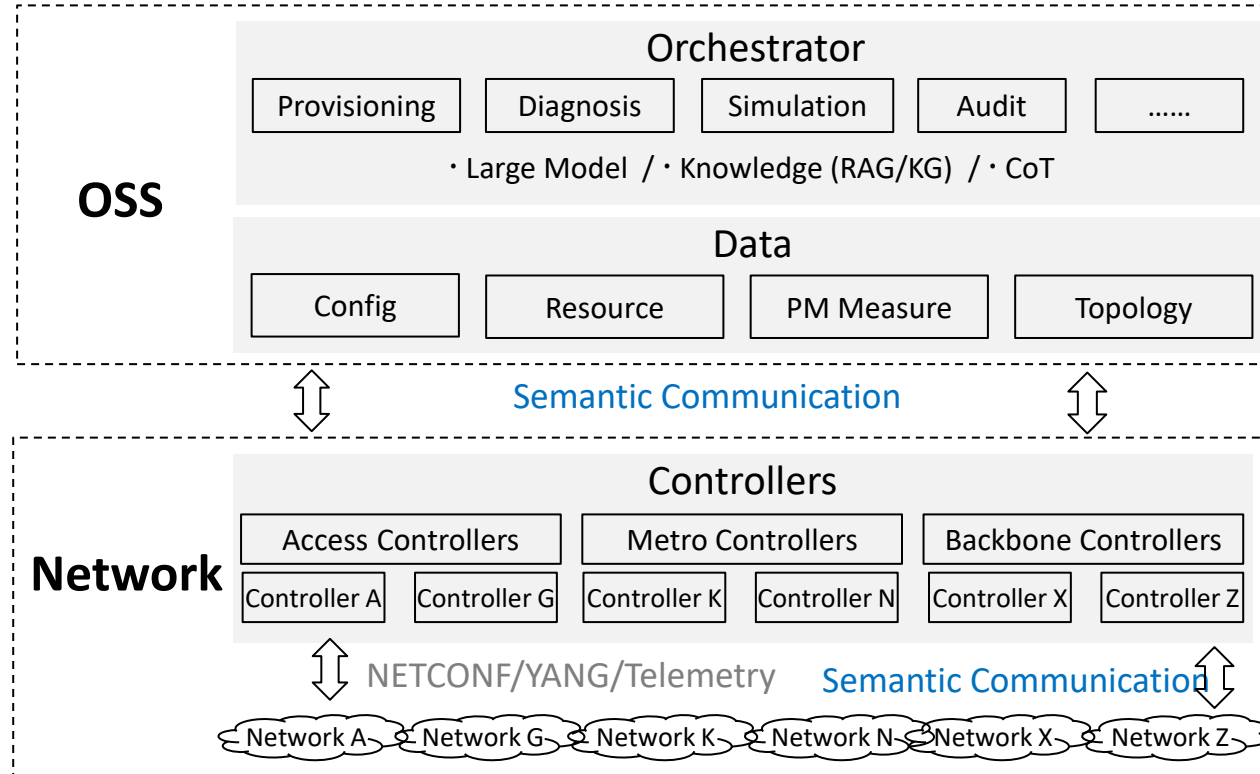
- **Network Monitoring** : Monitor resource utilization and SRv6 paths performance for SLA guarantee. It will send out notification in case of degradation.
- **Performance Prediction** : Build path quality prediction models based on historical time-series SRv6 path information.
- **Path Calculation** : path calculation & verification in real-time, paths take effect only after manual confirmation.

Calculating 100% SRv6 path at rate of 1000/s

Some Open Questions

AIOps must account for the end-to-end workflow—from monitoring and anomaly detection to root cause localization, network self-healing, and repair validation. There are 2 factors which are hard to address:

- long time to standardize the data and format reported to controller, e.g. telemetry, syslog, ipfix, events/alarms etc.
- enormous bandwidth and computational overhead incurred by telemetry data collection and processing.



Considering that network devices are able to run small models, e.g. iBNG (intelligent Broadband Network Gateway) deployed by China Mobile, some proposals:

- **Question 1:** Should we consider defining entire O&M network framework in AI Era.
- **Question 2:** Should we consider a new “semantic communication” protocol between devices and controllers — shifting from "data transfer" to intelligent "dialogue"?
- **Question 3:** Should we define the data format for the aforementioned semantic communication?

Questions?